

**(12) UK Patent Application (19) GB (11) 2 166 632 A**

(43) Application published 14 May 1986

(21) Application No 8428269

(22) Date of filing 8 Nov 1984

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(51) INT CL<sup>4</sup>  
**E02B 11/02**

(52) Domestic classification  
**A1B 5**

(56) Documents cited  
**GB A 2021912**  
**GB 1355302**

(58) Field of search  
**A1B**  
**Selected US specifications from IPC sub-class E02B**

**(54) Apparatus for filling drainage channels in greens**

(57) Apparatus for filling drainage channels in a green includes a tractor unit (4) with a hopper for gravel (6) at the front and a hopper for sand (8) at the rear. Control unit (10) operates control devices (46) and (76) on the respective hoppers for controlling the release of gravel and sand from the hoppers (6) and (8). The front hopper is vertically movable and is pivotable about a vertical axis so as in use to follow the previously cut drainage channel. Scrapers (14) scrape excess sand into the channel, and compaction of the sand and gravel in the channel is achieved by wheels (12) which run in the channel and a trailing drum-shaped wheel (58) which bridges the channel.

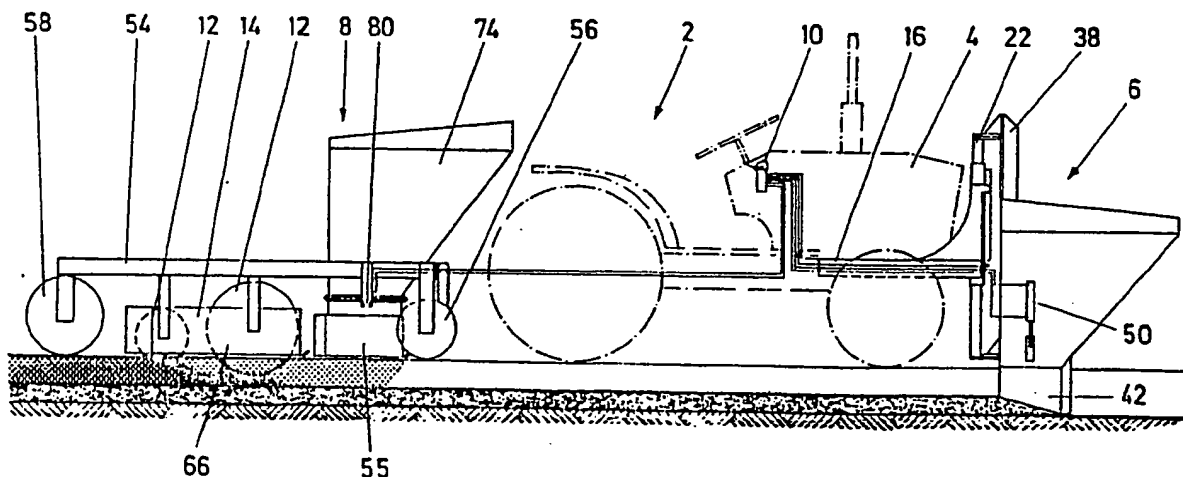
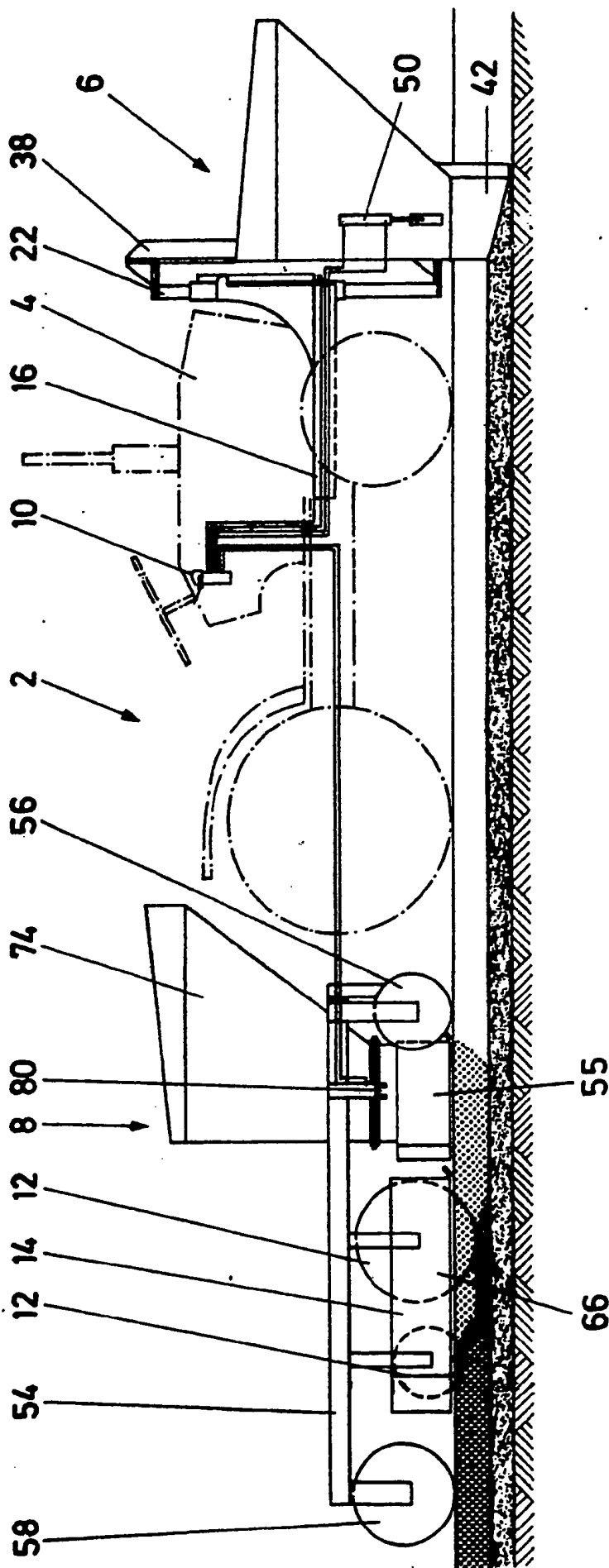
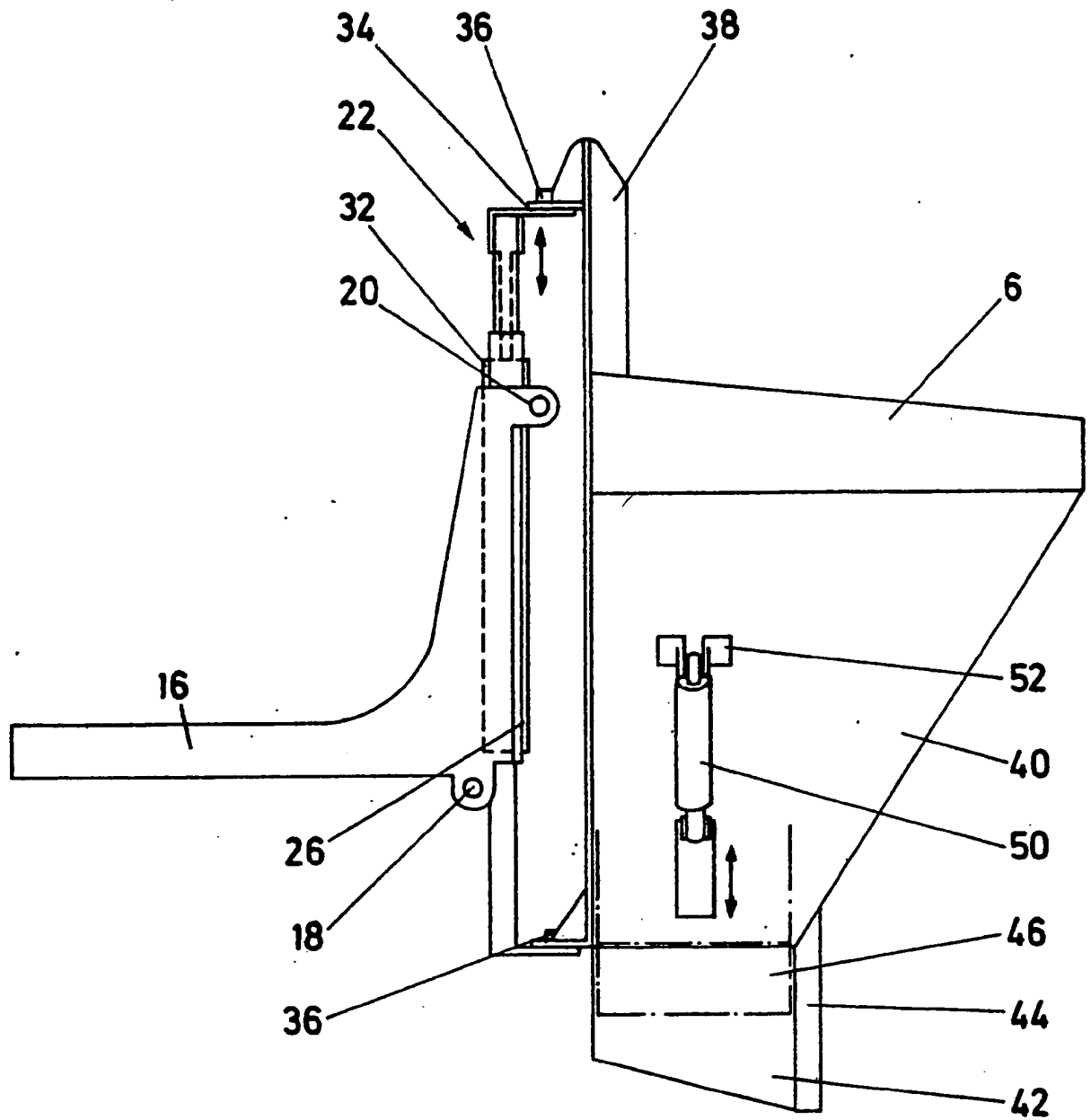


FIG. 1





**FIG. 2**

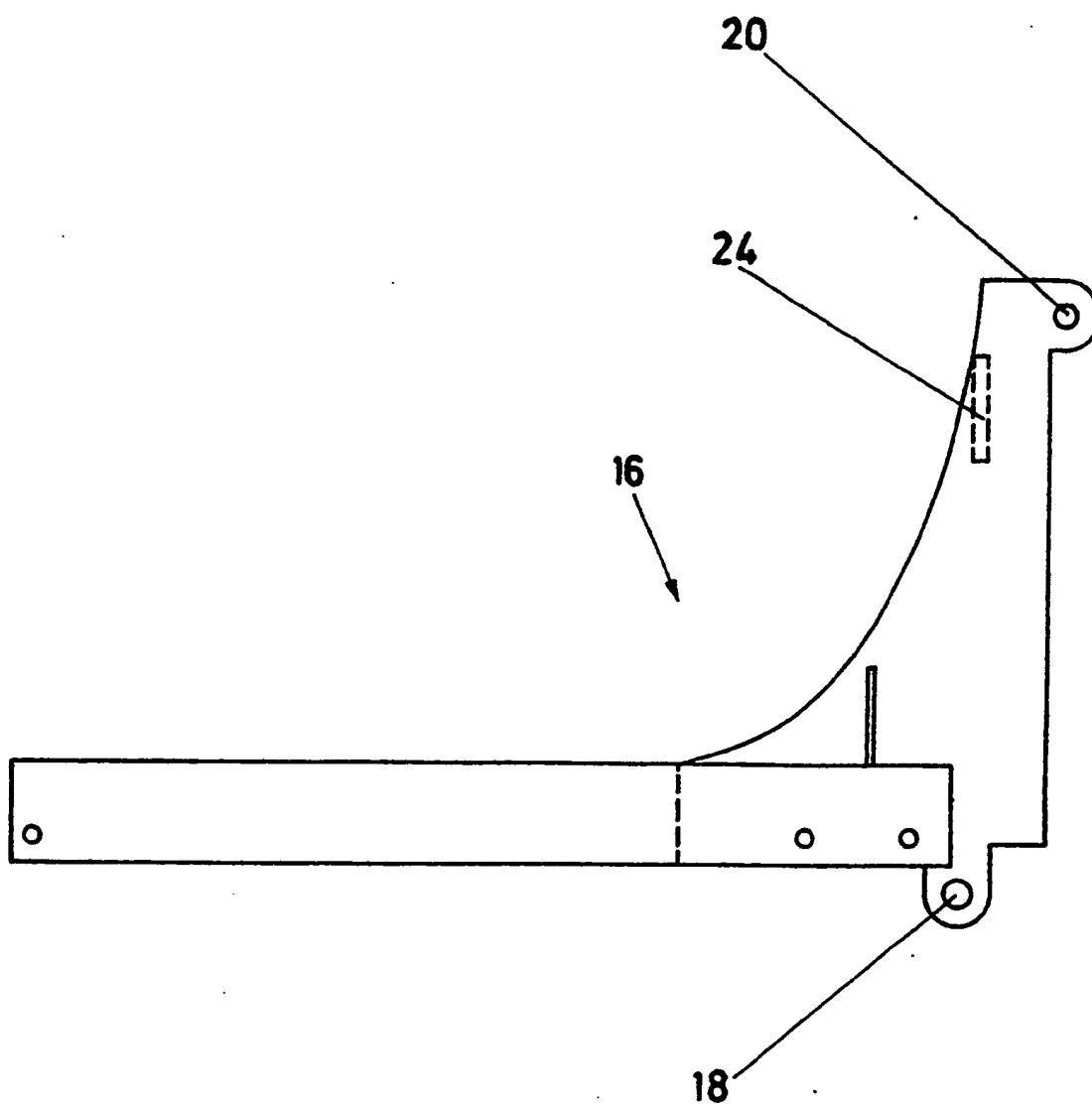


FIG. 3

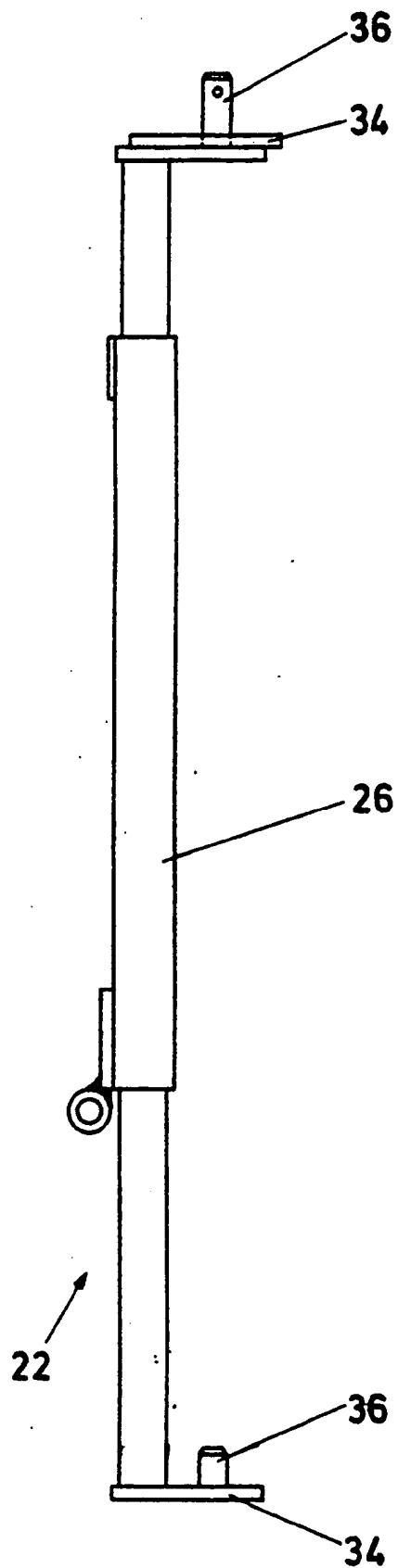


FIG. 4

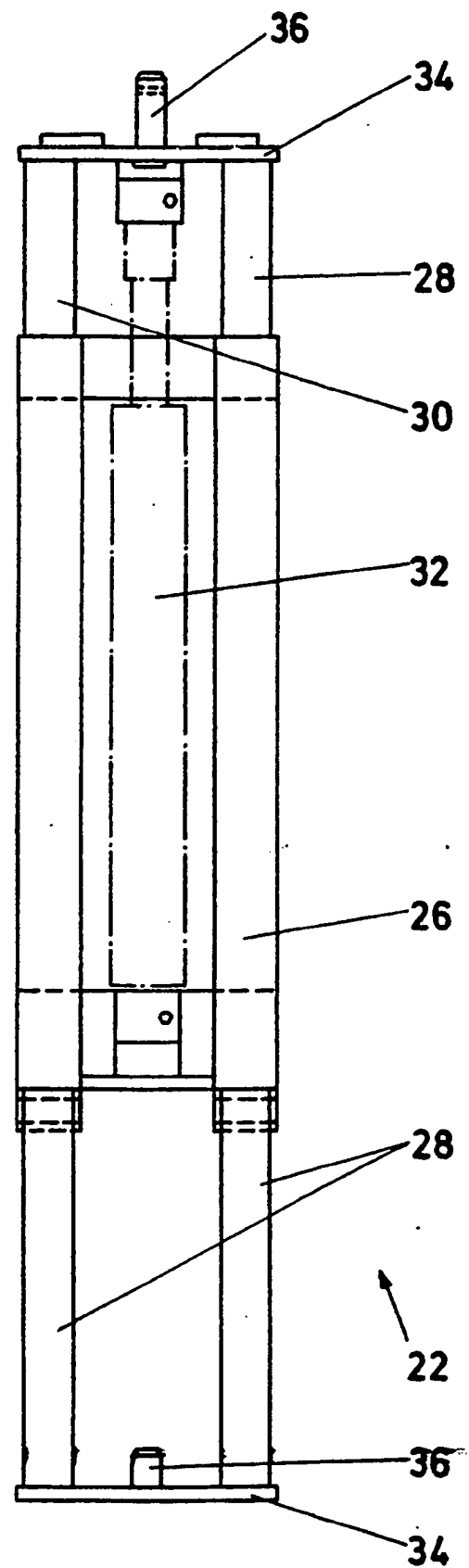


FIG. 5

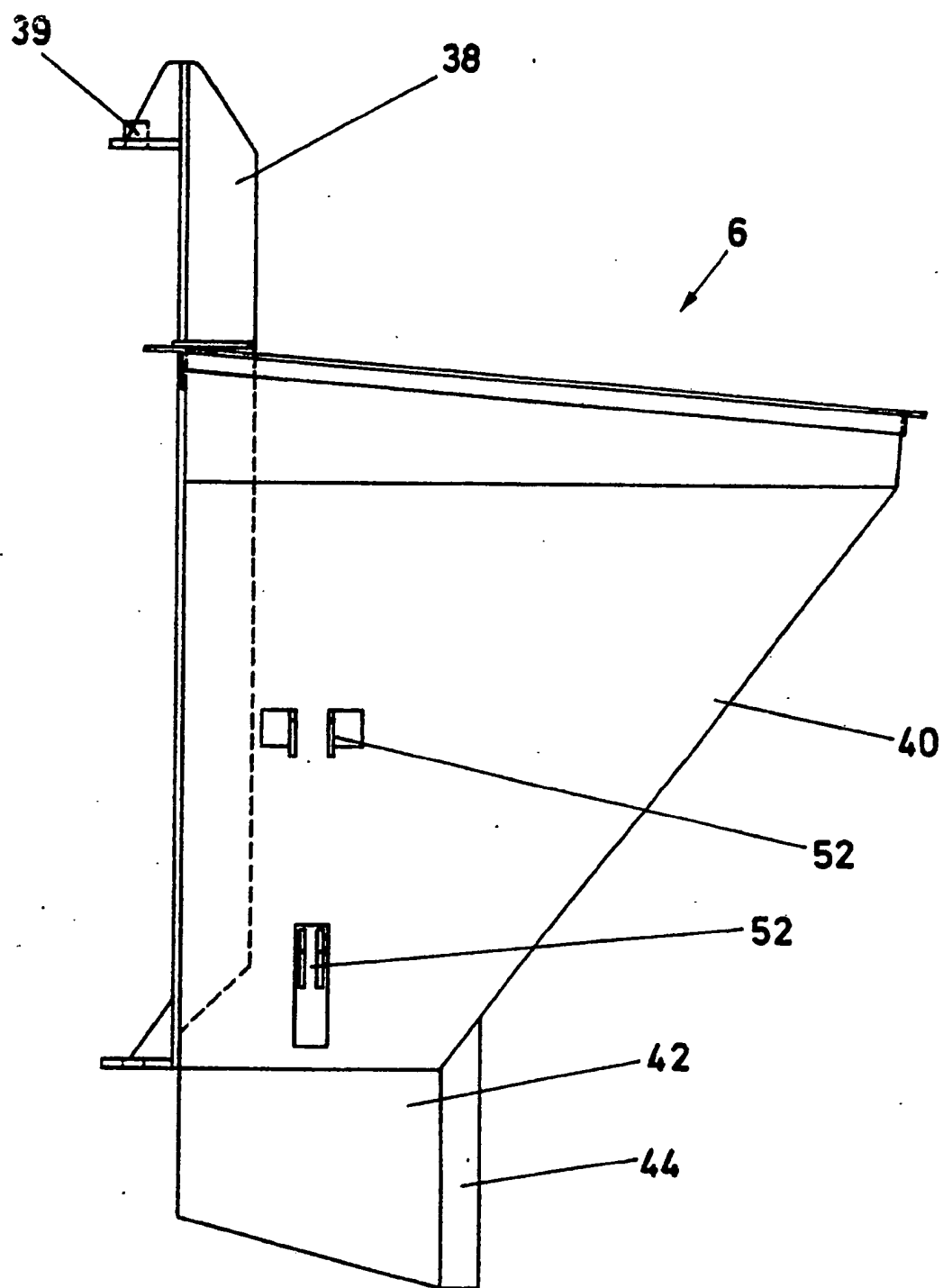


FIG. 6

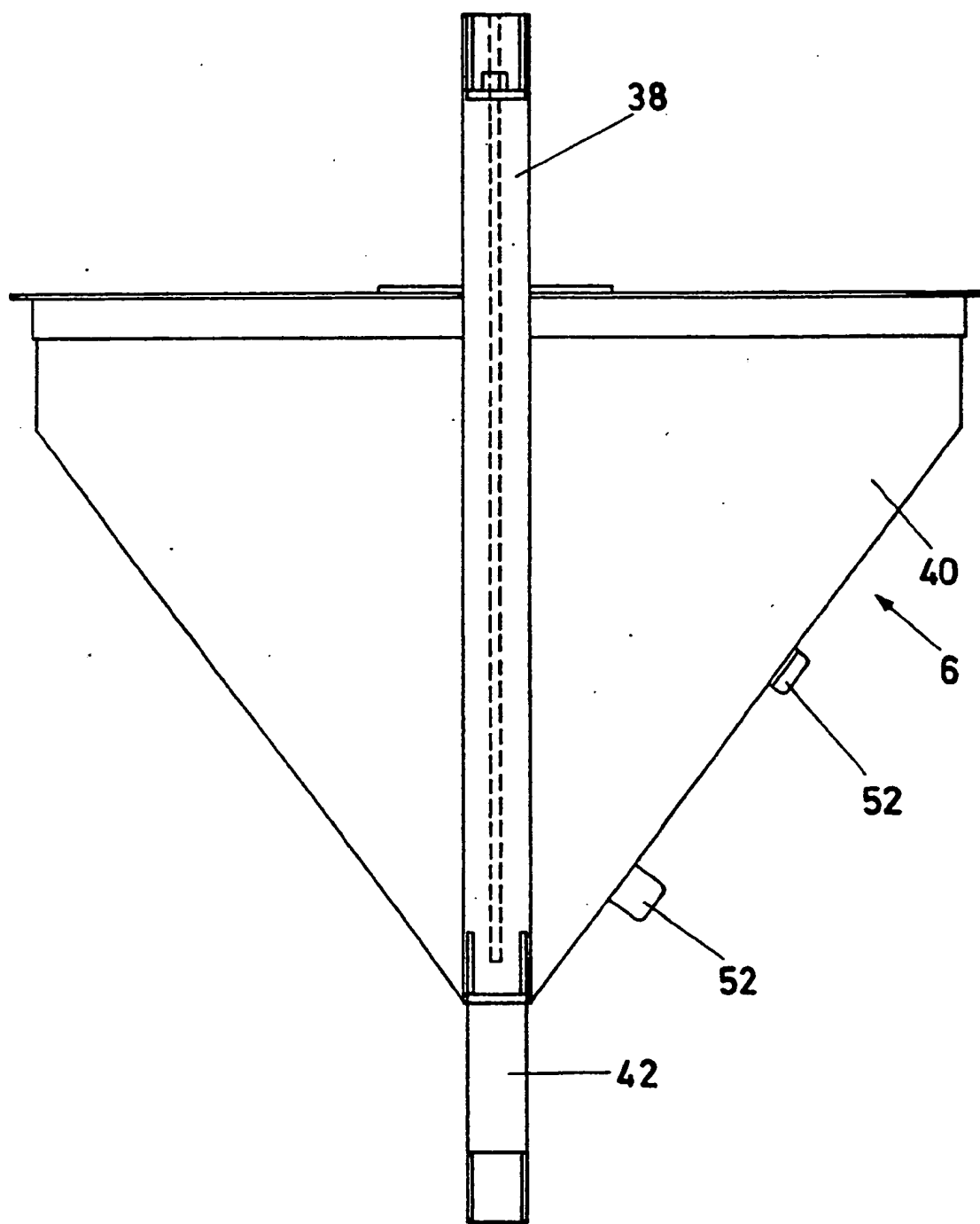


FIG. 7

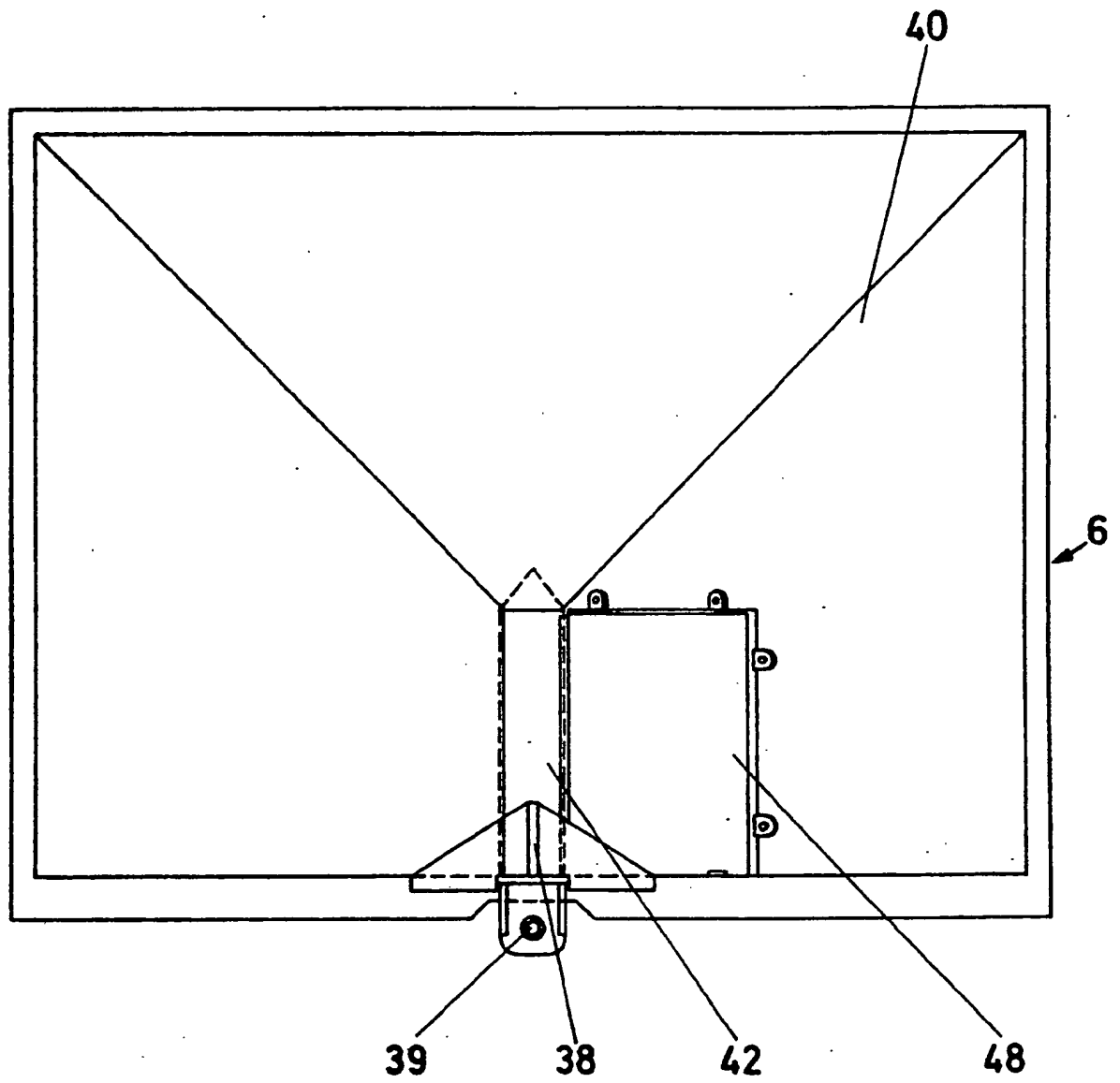
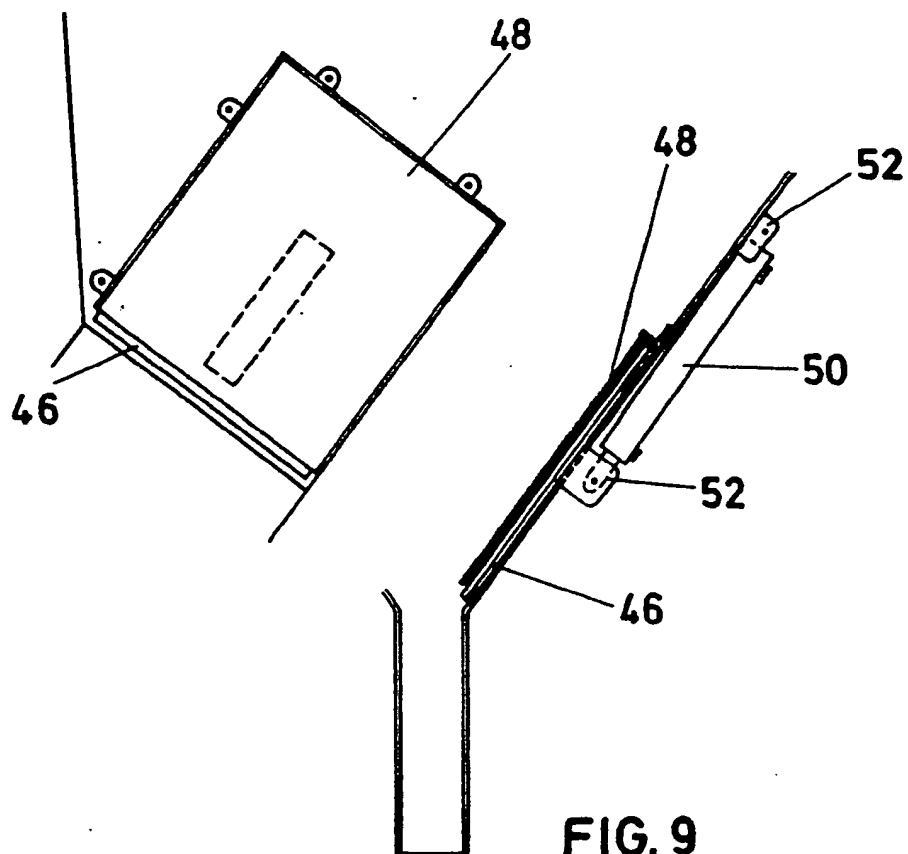


FIG. 8A



FIG. 8B



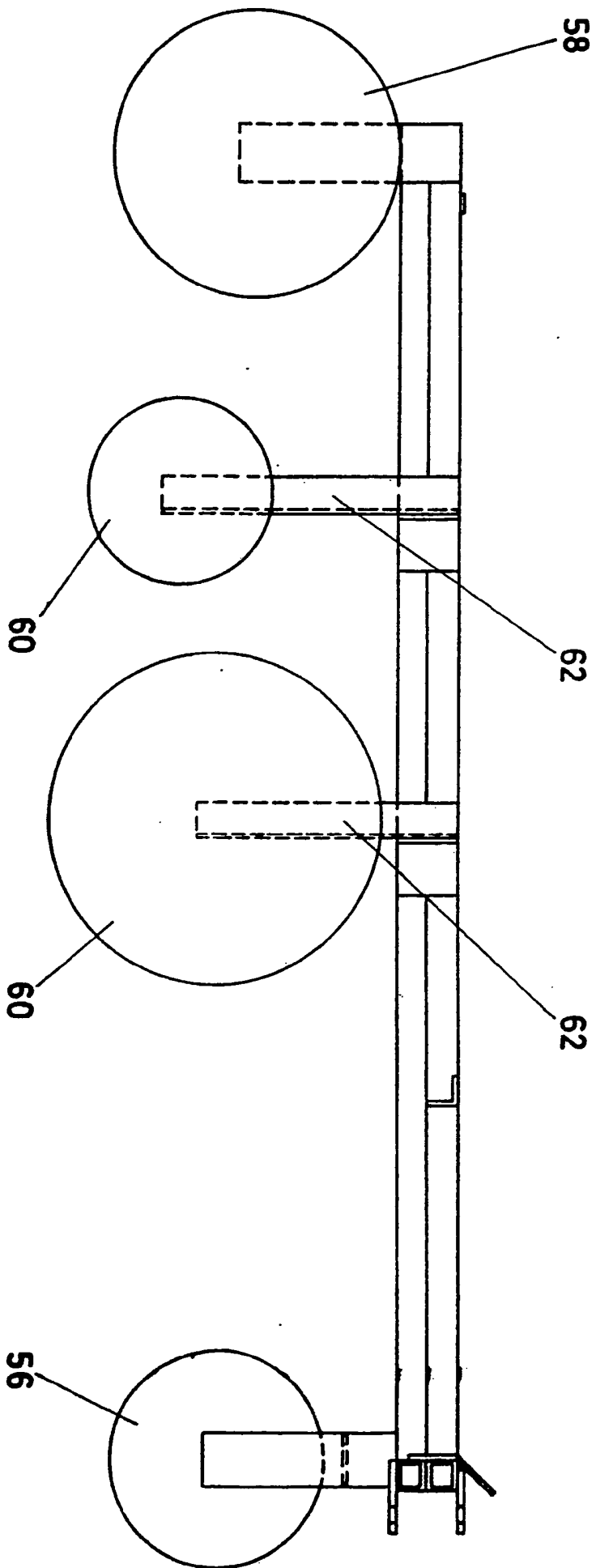


FIG. 10

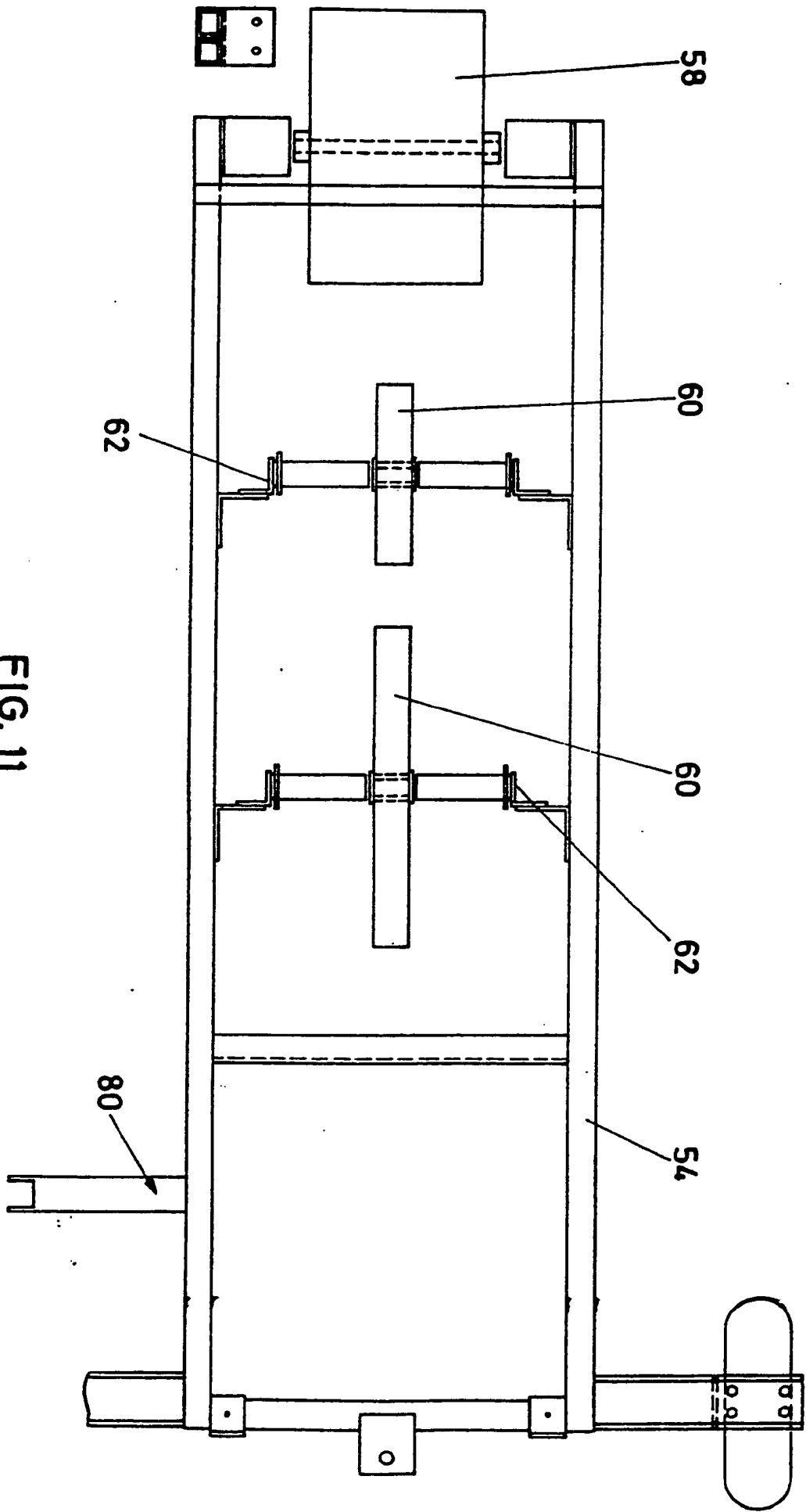


FIG. 11

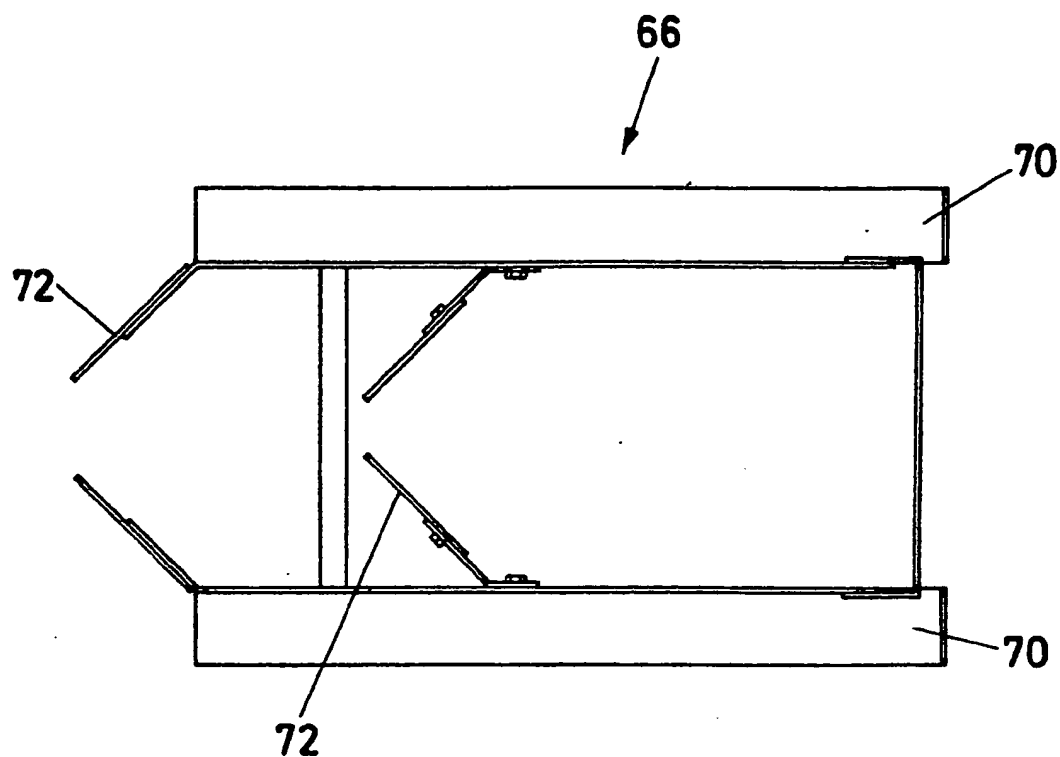


FIG. 13

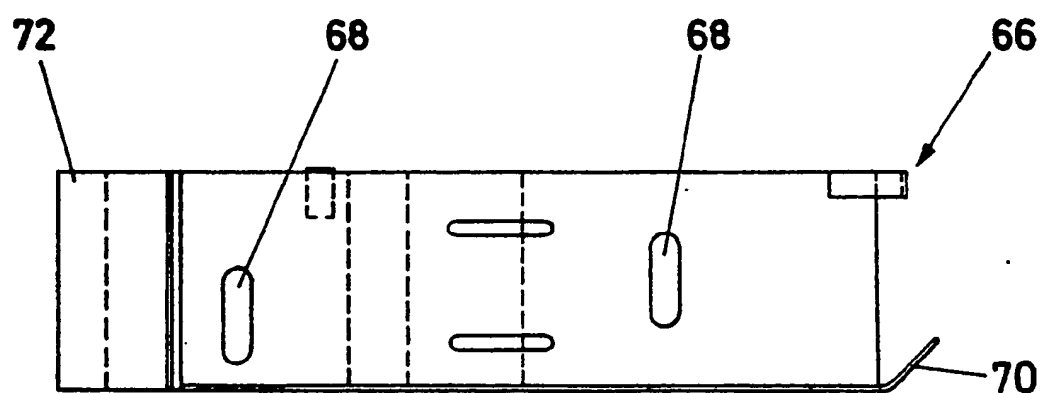


FIG. 12

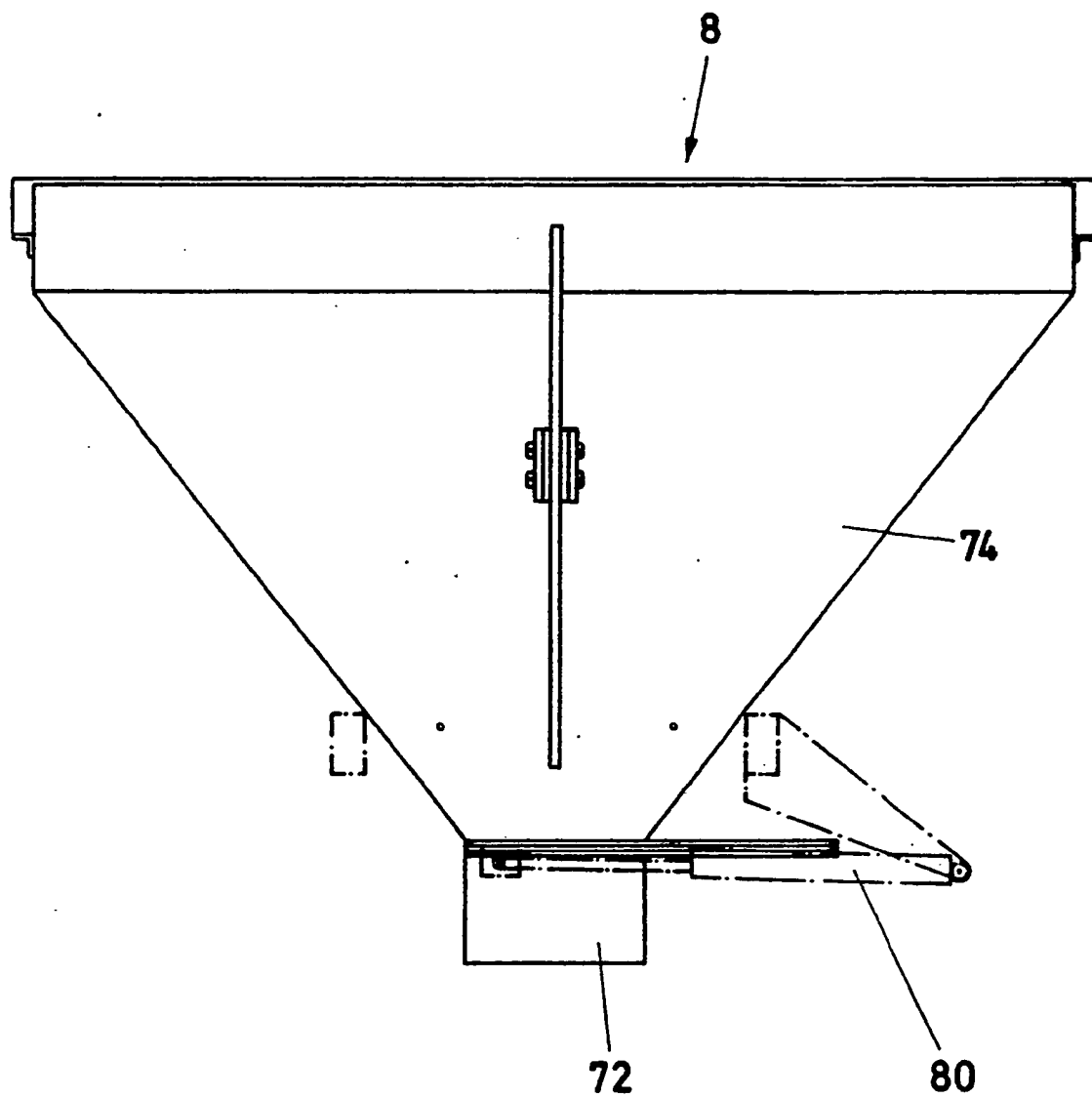


FIG. 14

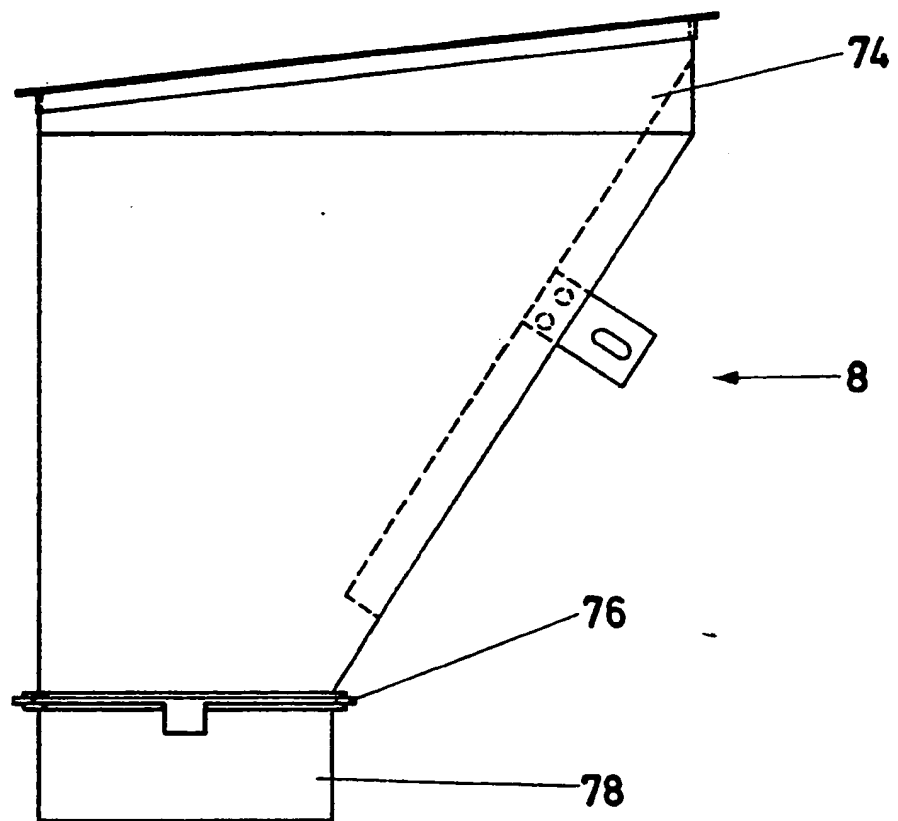


FIG. 15

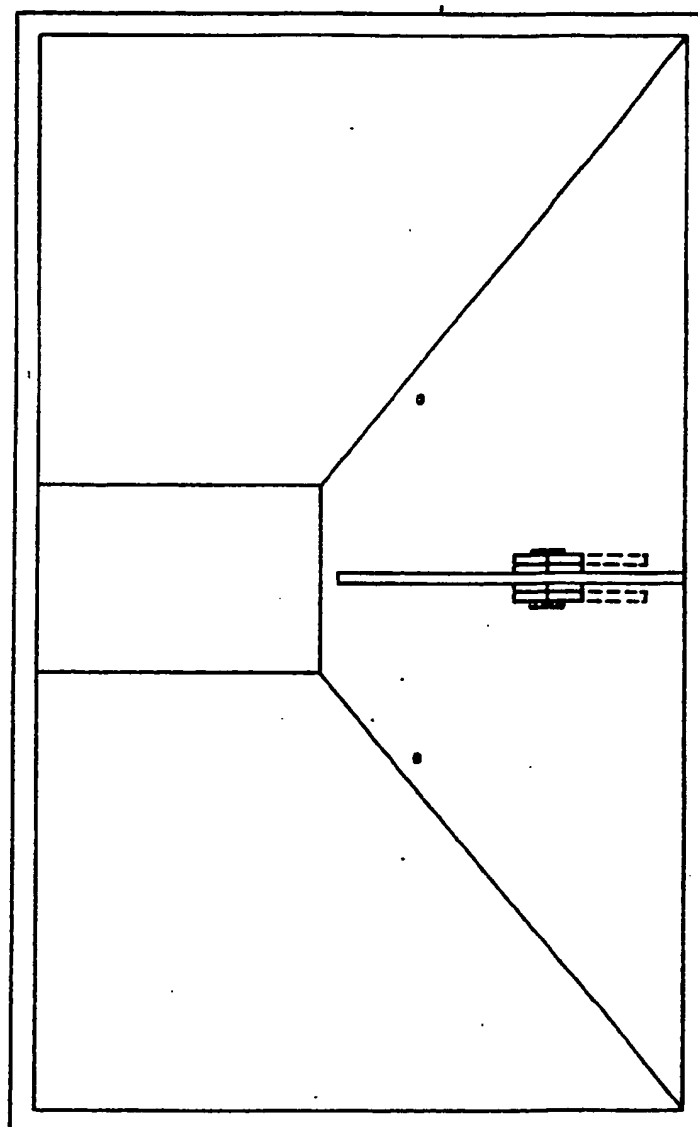


FIG. 16

## SPECIFICATION

## Apparatus for draining greens

## Field of invention

- 5 The invention relates to apparatus for draining greens in particular golfing greens by installing drainage channels under the turf. The invention may also be applied in draining other surfaces such as sports grounds etc.

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## Background of invention

- Apparatus for draining sports grounds and in particular football pitches is known having a pair of hoppers mounted on a three point linkage of an agricultural tractor. A narrow trench is cut and soil removed. Then the tractor passes, depositing first gravel from one hopper and then sand from the other hopper. The apparatus also mounts some wheels for compacting the sand and associated scrapers for channelling all sand to the trench areas. Finally grass seed is sown and after a while the pitch can be used once more.

- The apparatus is heavy and the tractor wheels may damage the grass surface; the filled hoppers are so heavy that it is very difficult to lift them and the distribution of gravel and sand cannot be controlled easily; at the beginning and end of the trench particularly there may either be excess or too little gravel or sand; and time is needed for re-establishing grass growth. The above features make the known apparatus unsuited for draining golfing greens which have to be used generally without prolonged interruption.

- It is amongst the objects of the invention to provide improved apparatus more suited for use on golfing greens, being less damaging to turf; more easily controlled; and/or capable of installing a drainage channel without turf destruction.

## 40 Summary of invention

- The invention provides apparatus for draining a green including a tractor unit, a hopper for gravel mounted at the front of the unit; a hopper for sand or similar soil material at the rear of the tractor unit and control means on the respective hoppers for controlling the release of gravel and soil material from the hoppers. The front and rear hopper placement spreads the weight of the apparatus on the tractor unit giving even weight distribution and reducing damage to the greens particularly if the tractor unit is a small low weight unit exerting a low ground pressure. The individual hoppers are more manageable in size and weight and appropriate control means can be effectively provided. Thus suitably the gravel hopper has a ram connected to a gate for controlling the rate of release of gravel through a narrow chute, the gate being capable of stopping release of gravel. Thus the apparatus can stop and start its action without giving rise to sudden uncontrolled releases of material.

- Preferably the gravel hopper is mounted for pivotal movement about an upright axis through at least a restricted angle to enable the hopper to follow a trench wall. Advantageously the tractor mounts a frame and a pillar assembly interconnects

the frame and the gravel hopper, the assembly including a ram for raising and lowering the gravel hopper. Thus the gravel hopper can follow the trench contours accurately and easily providing a controlled even gravel release.

- 70 The front hopper control can be paralleled at the rear hopper. Conveniently the hopper for sand has a ram connected to a gate for controlling the rate of release of the sand or soil material, the gate being capable of stopping the release of sand or soil material. Thus, although front and rear hopper are spaced well apart, they can stop and start their release at a predetermined common position in the trench. Suitably also at least two narrow wheels are mounted independently adjustable for height to compact sand or soil material released into the trench and scraper blades are arranged on either side of the wheels to the rear thereof to return surplus material to the trench and a wide wheel is mounted behind the final narrow wheel to bridge across the width of the trench and level the sand or soil material across the width of turf removed to either side of the trench. The hopper control is thus complemented by a compaction control to provide a level surface which can be re-turfed by re-applying the strip of turf previously removed.

- The green can be recommissioned without seeding etc and is ready for use shortly after the drainage channels have been installed under the turf.

## Drawings:

Figure 1 shows a side view of an apparatus according to the invention;

- 100 Figure 2 is a side view in more detail of a front hopper of the apparatus of Figure 1;

Figure 3 is a side view of a mounting frame for the front hopper of Figure 2;

- Figures 4 and 5 are side and front views of a hopper mounting post for securing on the frame of Figure 3;

Figures 6, 7 and 8A are side, rear and top views respectively of the front hopper for mounting on the post of Figure 4;

- 110 Figures 8B and 9 show hopper details;

Figures 10 and 11 show side and top views of a rear hopper support frame for the apparatus of Figure 1;

- Figures 12 and 13 show side and top views of a scraper for mounting on the support frame of Figure 9; and

Figures 14, 15 and 16 show a transverse section and side and top views of the rear hopper for mounting on the frame of Figure 9.

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## Description of Preferred Embodiment

- Figure 1 shows an apparatus for installing a drainage system under a golfing green in a general view. The apparatus 2 includes a tractor unit 4 to which is attached a hopper for gravel 6 at the front and a hopper for sand 8 at the rear. A control panel 10 for controlling the various functions of the apparatus is located near the driver's position on the tractor unit 4. Behind the rear hopper there are mounted wheels 12 for compacting material



released from the hoppers 6 and 8 and a scraping mechanism 14 for placing the material in the trench. In the following the construction of the apparatus 2 will first be described in detail. This will be followed by a description of how the apparatus is used in practice.

To mount the front hopper 6, a pair of generally L-shaped fabrications 16 are bolted to either side of the front of the tractor unit 4. The fabricated frame 16 does form a pair of transversely spaced holes 18 for pivotably supporting a hopper mounting post assembly 22 and a pair of holes 20 through which a rod can be passed to trap the assembly 22 in position against a pair of lugs 24 on the fabrication 16. Thus by removing the rod passing through the holes 20 the hopper 6 can be permitted to tip forward (Figures 2 and 3).

The hopper mounting post assembly 22 (see Figures 4 and 5) consists of a pair of hollow spaced apart uprights 26 and a slide 28 having a pair of pillars or members 30 slidable vertically through the uprights 26 in the direction of arrow A in Figure 2. A piston and cylinder device 32 is secured between the uprights 26 to controllably move the slide 28 upwards and downwards in accordance with the requirements. Cross-plates 34 tie the members 30 together at the top and bottom and carry upstanding pivot pins 36 to which the hopper 6 proper may be secured.

With reference to Figures 6 to 8, the hopper 6 has an upright spine member 38 having apertures on brackets at the top and bottom for fitting over the pivot pins 36. The hopper 6 consists principally of inclined side walls 40 which converge towards the lower end to a chute 42 of a limited width which is shielded at the front by a triangular member 44. On one of the side walls 40 there is provided a slidable gate 46 underneath a cover plate 48. A piston and cylinder device 50 can be mounted in brackets 52 on the side wall 40 concerned and the slidable gate 46 to raise and lower the gate 46 between the positions shown in chain-dotted lines in Figure 2. In the lower position the gate 46 extends across the chute 42 and blocks the downward movement of gravel in the hopper 6. In the upper position the gate 46 permits the gravel to fall without hindrance from the hopper into the chute 42. The gate 46 is movable in the direction of the arrow B shown in Figure 2. The precise mounting of the slidable gate 46 can be seen in more detail in Figures 8 and 9.

Because the hopper 6 is supported to the tractor unit 4 by means of the pivot pins 36 on the upright frame 26, the hopper 6 can swing around through about 5° from a centre position to either side in order to accommodate any curvature or irregularity in the line of the trench. Jamming of the hopper 6 into the ground can thus be largely avoided. At the same time the hopper 6 can be moved up and down by operation of the piston and cylinder device 32 so as to adjust its height to operational requirements.

With reference to Figures 10 and 11, the rear hopper for sand 8 is supported on a frame 54 attached to the three point linkage of the tractor unit 4. The three point linkage may have an extra piston and cylinder device (not illustrated) to enable the

three point linkage to raise the frame 54 from the ground if necessary even when the hopper 6 is fully loaded. In use, the frame 54 is supported on the ground by means of wheels 56 at the front and a wide, hollow drum-shaped wheel 58 at the rear. The frame 54 also mounts a pair of narrow wheels 60, having the width of the trench, on posts 62 depending from the frame 54. The front wheel 60 has a large diameter whereas the rear wheel 60 has a small diameter. The posts 62 can be secured at a number of different heightwise positions on the frame 54 so as to vary the operating height of the wheels 60 in accordance with requirements.

With reference to Figures 12 and 13 a scraper frame 66 is secured to the frame 54 with upwardly elongated holes 68 being situated in line with the axes of the wheels 60. The frame 66 has a pair of transversely spaced horizontal flanges 70 to ensure that the frame follows the ground contours, the elongated holes 68 permitting limited up and down travel of the frame 66 with respect to the rear frame 54. The frame 66 also carries two pairs of inclined scraper blades 72 arranged generally upright so as to scrape any loose soil back towards the trench as the tractor progresses along the trench.

The rear hopper 8 has walls 74 (see Figures 14 to 16) which are inclined to converge downwardly towards a chute 78. A gate 76 is slidably mounted at the bottom of the hopper 8 for movement in a horizontal plane by a piston and cylinder device 80 so as to control the release of sand from the hopper 8. The hopper 8 is bolted to the front end of the frame 54. Scrapers 55 channel the sand released and ensure that it is deposited in the trench.

The apparatus 2 is used as follows. Firstly a strip of turf is removed from the golfing green and placed aside. A narrow trench is then cut centrally along the strip from which the turf has been removed.

Generally speaking a number of trenches will be cut in this manner spaced parallel to each other so as to cover the whole golfing green surface.

Next the narrow wheels 60 are set to the height in which they are required to operate. This will depend on the depth of the trench cut which may vary to take into account the conditions of the sub-surface locally. The front hopper 6 is then filled with gravel and the rear hopper 8 is filled with sand. The apparatus 2 is then driven to line up with the start of a trench. As the tractor unit 4 commences to move forward with the chute 42 located substantially in the bottom of the trench, the slide gate 46 is opened so that gravel is released from the hopper 6. As the rear hopper 8 lines up with the start of the trench shortly afterwards, the gate 76 is operated by means of the piston and cylinder device 80 from the control panel 10 on the tractor unit 4 to place a layer of sand on top of the gravel in the trench. As the apparatus 2 moves forward the hopper 6 will automatically follow the contour of the trench as it pivots about pivot pins 36 under the guidance of the triangular piece 44 and the chute 42 actually located inside the trench. By operating the piston and cylinder device 32 from the control panel 10, the operator can ensure that the bottom of the chute 42 continues to follow the bottom of the trench so as to avoid

sudden releases of gravel.

Whilst the apparatus is moving forward the wheels 60 will ride in the trench with the leading wheels 60 deeper than the following wheel 60.

- 5 Excess sand pushed out by the leading wheel 60 will be scraped back into the trench by the inclined scraper blades 72 of the scraper frame 66 which rides on top of the surface. This operation is repeated after the trailing wheel has passed through the trench and the compaction is completed by the drum-shaped wheel 58 at the rear of the frame 54 which forms the sand into a level surface. During this process the operator can control the gate 76 whilst the tractor drives forward so as to ensure that the amount of sand released is neither too much nor too little.

When the operation is completed, first the release of gravel is stopped and then the release of sand so that the trench is filled from beginning to end in an identical fashion without an accumulation of gravel and/or sand at the ends.

The turf previously put aside can then be replaced so that the end result will be that the golfing green is restored to its original condition but has installed under it a series of drainage channels which will prevent the accumulation of water on the green.

The location of the gravel hopper at the front of the tractor unit and the possible adjustment of its position both heightwise and pivotally, enables gravel to be dispensed without overloading the rear of the tractor and preventing the wheels of the tractor from leaving an imprint in the green. The overall operation can be controlled in an accurate manner permitting drainage channels to be produced whilst leaving a level surface for re-turfing.

Whilst the low ground pressures involved in operation of the apparatus and the ease of control are of paramount importance for draining golfing greens, it will be readily understood that the same apparatus can also be used in applications where the requirements are less critical. Thus the apparatus of the invention may also be used for draining sports grounds such as football grounds etc.

## CLAIMS

1. Apparatus for draining a green including a tractor unit, a hopper for gravel mounted at the front of the unit; a hopper for sand or similar soil material at the rear of the tractor unit and control means on the respective hoppers for controlling the release of gravel and soil material from the hoppers.
2. Apparatus according to claim 1 in which the tractor unit is a small low weight unit exerting a low ground pressure.
3. Apparatus according to claim 1 or claim 2 in which the gravel hopper has a ram connected to a gate for controlling the rate of release of gravel through a narrow chute, the gate being capable of stopping release of gravel.
4. Apparatus according to any of the preceding claims in which the gravel hopper is mounted for pivotal movement about an upright axis through at least a restricted angle to enable the hopper to follow a trench wall.
5. Apparatus according to any of the preceding claims in which the tractor mounts a frame and a pillar assembly interconnects the frame and the gravel hopper, the assembly including a ram for raising and lowering the gravel hopper.
6. Apparatus according to any of claims 2 to 5 in which the hopper for sand has a ram connected to a gate for controlling the rate of release of the sand or soil material, the gate being capable of stopping the release of sand or soil material.
7. Apparatus according to claim 6 in which at least two narrow wheels are mounted independently adjustable for height to compact sand or soil material released into the trench and scraper blades are arranged on either side of the wheels to the rear thereof to return surplus material to the trench.
8. Apparatus according to claim 7 in which a wide wheel is mounted behind the final narrow wheel to bridge across the width of the trench and level of the sand or soil material across the width of turf removed to either side of the trench.
9. Apparatus for draining a green substantially as shown in and described with reference to the Figures.

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